United States
Department of
Agriculture

Natural
Resources
Conservation
Service

September 1999

Watershed Science Institute Technical Report

Stream Corridor Inventory and Assessment Techniques

A guide to site, project and landscape approaches suitable for local conservation programs

Prepared by an interdisciplinary and multi-organizational team under the leadership of the Watershed Science Institute (Seattle, Washington), USDA-Natural Resources Conservation Service (NRCS). The institute is composed of an interdisciplinary group of specialists located at university locations throughout the United States. The vision of the Watershed Science Institute is "healthy watersheds and sustainable landscapes." Additional information can be obtained at http://www.geology.washington.edu/~nrcs-wsi.

Contents:

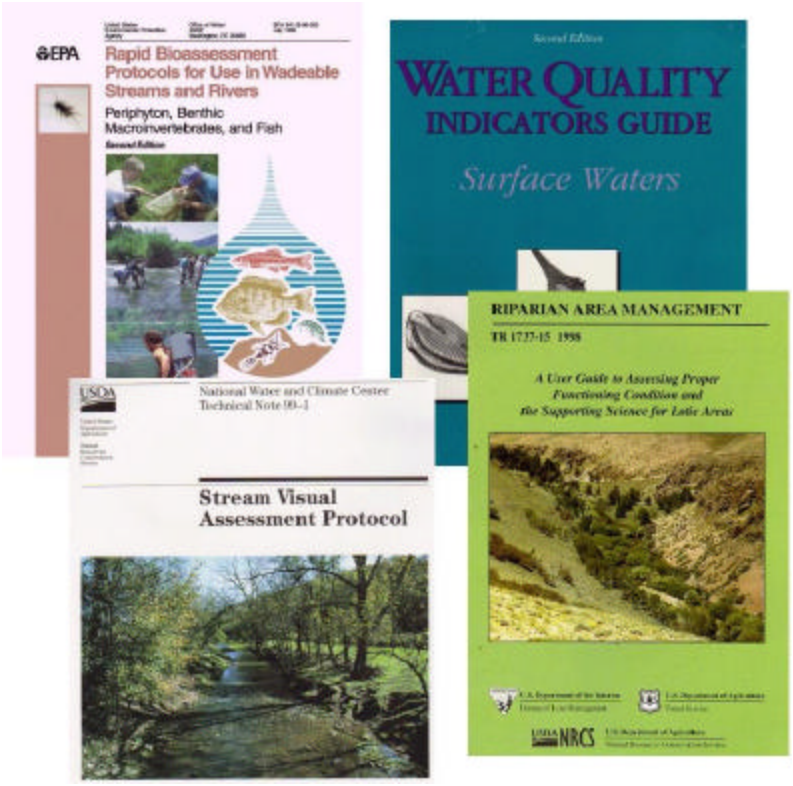

Figure 1. A variety of notable site-level inventory and assessment techniques have been developed and perfected over recent years to help address the conservation and management of stream corridors. Stream corridors and the water flowing through them are critical elements of the landscape and key indicators of watershed condition.

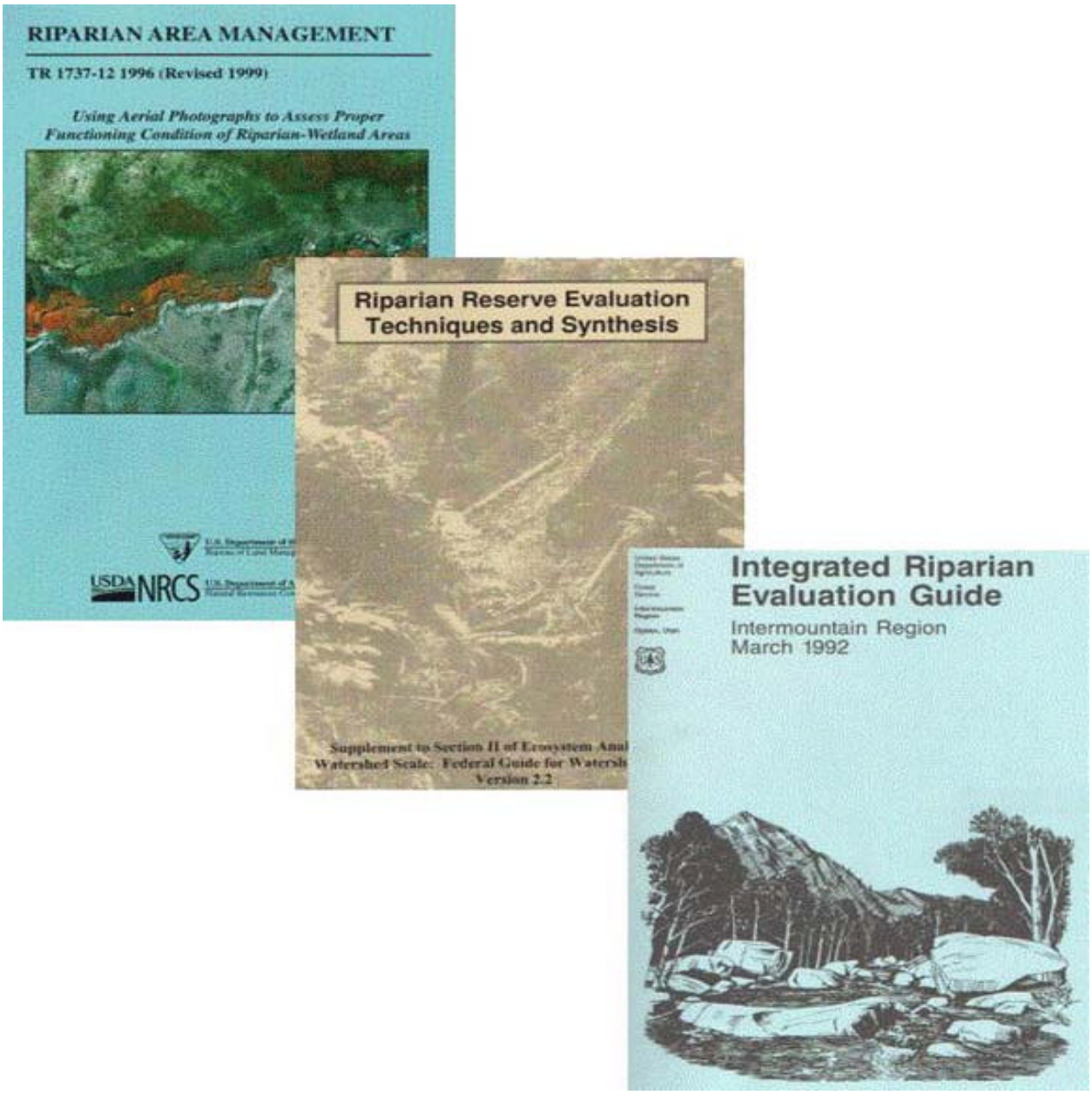

Figure 2. Some stream corridor inventory and assessment techniques (examples shown above) have been developed to be applied with remote sensing (satellite imagery and aerial photographs). Notwithstanding, the data and results of site-level techniques can always be aggregated to landscape and watershed levels.

Introduction

The purpose of this guide is to help land managers, landowners and stakeholders find appropriate inventory and assessment techniques to answer questions about their stream corridor conditions. This guide provides the titles, reference citations, a descriptive summary and attributes of notable stream corridor inventory and assessment techniques that are suitable for local conservation programs. Such programs are typically pursued at the site or project level with increasing attention being given to the landscape scale to optimize future treatments, management and monitoring.

Stream corridors - extent, function and values

The United States has more than 3.5 million miles of rivers and streams. Associated with these are riparian and wetland areas that are important for their economic, social, cultural and environmental values. These water courses and areas are complex, multi-dimensional ecosystems that perform a number of functions such as water storage, energy dissipation, sediment trapping, and water temperature moderation as well as providing important habitat.

Stream corridors also have soil characteristics and vegetation distinctly different from the surrounding uplands. They support a greater diversity and abundance of species and rate of productivity than other ecosystems.

Dynamic equilibrium

Streams and stream corridors respond in concert with and in response to surrounding ecosystems. Changes in the watershed can impact the physical, chemical, and biological processes occurring within a stream corridor. Stream systems function within natural ranges of flow, sediment movement, and other variables, in what is called “dynamic equilibrium.”

A natural channel migrates laterally by erosion of one bank, maintaining on the average a constant channel cross section by deposition on the opposite bank. There is a dynamic equilibrium between erosion and deposition. The form of the channel cross-section is stable (i.e., more or less constant), but the position of the channel within its valley is not (Leopold 1994).

Cumulative effects of disturbance

When conditions in the surrounding watershed are altered to the degree that dynamic equilibrium is disturbed, a series of adjustments to the stream corridor will ensue. Over time, when conditions in the watershed stabilize, a new dynamic equilibrium will develop in the stream corridor (USDA-NRCS 1999).

Human activities have contributed to changes in the dynamic equilibrium of stream systems across the nation. The cumulative effects of these activities has resulted in significant changes, not only to stream corridors, but also to the ecosystems of which they are a part. These changes include degradation of water quality, decreased water storage and conveyance capacity, loss of habitat for fish and wildlife, and decreased recreational and aesthetic values (National Research Council 1992). According to the 1996 National Water Quality Inventory of 693,905 miles of rivers and streams, approximately 40 percent were impaired. Siltation, nutrients, and pathogens were the most common causes of degradation (U.S. EPA 1998)

The need for stream corridor inventories and assessments

Given the current condition of rivers and the heightened public interest in them, there is a significant need for the ability to determine the health of streams. The current stability and functionality of the stream is an important consideration that should be addressed at the start of a restoration project. Trying to impose a restoration strategy on a situation that is currently unstable is generally impractical and often costly.

The stream corridor inventories and assessments listed in this guide represent a partial catalog of tools currently available for determining

conditions of the stream and its associated corridor. The information will assist local watershed groups in developing goals and formulating plans. These tools are also useful at the site scale and to establish base line conditions and evaluate cause-and-effect relationships.

Literature cited

Leopold, Luna B. 1994. *A view of the river*. Harvard University Press, Cambridge, MA.

National Research Council (NRC). 1992. *Restoration of aquatic ecosystems: science, technology, and public policy*. National Academy Press, Washington, DC.

United States Environmental Protection Agency (USEPA). 1998. *National water quality inventory: 1996 report to Congress*. EPA841-R-97-008. U.S. EPA Office of Water, Wash., DC.

USDA-NRCS. 1999, *Personal communication - Intermountain Riparian/Wetland Resource Technical Team.* USDA - Natural Resources Conservation Service. Bozeman, MT.

The layout of the guide

The accompanying table, "Attributes of Stream Corridor Inventory and Assessment Techniques," is the core of the guide and provides an overview description of individual techniques. Techniques are grouped by the primary stream corridor setting to which they pertain and are arranged in alphabetical order. Standard dictionary definitions for terms are assumed unless otherwise noted. Explanations of attribute ratings (columns 1-6 of the table) are:

1. The ***Primary Setting*** that the particular technique addresses (note: many techniques are used for additional primary or secondary settings):
   - ***Channel-floodplain***
   - ***Riparian area***
   - ***Water quality (properties; contaminants)***
   - ***Aquatic habitat***

2. The ***Sampling Intensity***:
   - ***Cursory*** (preliminary, i.e., observations and estimates of conditions and attributes are made usually without the need for specific measurements or quantification)
   - ***Detailed*** (comprehensive, i.e., conditions and attributes are itemized and specifically measured)

3. The required ***Skill Level, Training*** and ***Time*** to properly carry out the technique, each rated as ***High*** *(Skill level: specialists with considerable specialized expertise; Training: 3-5 days; Time: generally 4 or more hours per site)*, ***Medium*** *(Skill level: specialists with basic specialized expertise; Training: 1-3 days; Time: generally 1-3 hours per site),* or ***Low*** *(Skill level: professionals or technicians trained in the technique; Training: 1 day or less; Time: usually less than 1 hour per site)*

4. The technique's classification as to ***Kind*** *(****Inventory*** *- a collection of data* or ***Assessment*** *- a collection of data and value judgement as to condition),* ***Measure Type*** **(*Qualitative*** *- using charts, tables, attribute groupings or illustrations to classify or rate, or* ***Quantitative*** *- measurements, dimensions, quantities*) and ***Proximity*** (***Onsite*** *- observers or data collectors physically at the site, or* ***Remote*** *- observers or data collectors can use satellite imagery or aerial photos)*

5. The need for a ***Reference Site*** (***Yes, No*** or ***Optional***) - a reference site is a representative segment or reach of a stream corridor system in dynamic equilibrium with a relatively undisturbed watershed

6. The technique's ***Suitability for Monitoring*** (***High*** *- suited for statistical analysis with consistent results between different collectors at the same site and accurate detection of change/trend over time,* ***Medium*** *- reproducible or repeatable results but generally not suited for statistical analysis,* or ***Low*** *- not intended for monitoring purposes*)

The ratings for the attributes in the table were developed by a team of interdisciplinary specialists (listed in the acknowledgements section below) with experience in stream corridor inventories and assessments.

Another important part of the guide is the section, "Summaries - Individual Techniques," which follows the table. For each technique, a full citation, source address, summary and a copy of the front cover are provided. Techniques are arranged in alphabetical order. Readers are encouraged to obtain and test the techniques that appear promising for the settings and requirements of their local sites and watersheds. If the reference is currently unavailable, contact the NRCS-Watershed Science Institute, c/o GEO SCI, UW, Box 351310, Seattle, WA 98195-1310.

Acknowledgements

The work contained in this document was led and funded by NRCS's Watershed Science Institute. Recognition is given to the many authors of the techniques contained in this report and the team of specialists listed below who collaborated on methods to include, attribute ratings, and summary descriptions.

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Special recognition for administrative and technical support is given to:

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*Team Leader

Table. Attributes of Stream Corridor Inventory and Assessment Techniques.

Column notes listed below >	1	2	3	4	5	6
Technique (to obtain a technique's citation and summary, turn to the page number listed in parentheses)	Primary Setting (listed first)	Sampling Intensity	Skill Level, Training, Time	Kind, Measure Type, Proximity	Reference Site Needed	Suitability for Monitoring
***Primary Setting* - Channel-floodplain**						
Applied River Morphology. Wildland Hydrology Consultants, 1996. D. Rosgen, Pagosa Springs, CO (14)	C	D	M/L-H-H	I/A-N-O	Y	M
Channel-Reach Morphology in Mountain Drainage Basins. Geological Society of America Bulletin, 1997. D.R. Montgomery and J.M. Buffington, University of Washington, Seattle, WA (14)	C	C	M-M-M	I-L-O	O	M/H
Incised Channels - Morphology, Dynamics and Control. S.A. Schumm, M.D. Harvey, and C.C. Watson, 1984. Littleton, CO (16)	C	C	M-M-L	I-L-O	N	M
Procedures for Using [the] Oregon Stream Habitat Data Sheet. USDA-NRCS, 1998. Portland, OR (19)	C,R,A	D	M-M-L	I/A-L/N-O	N	M
Rapid Stream Assessment Protocol (RSAT) Field Methods - Appendix A. J. Galli, Sr., 1996. Dept. of Environmental Programs, Metropolitan Washington Council of Governments, Washington, DC (21)	C,R,W,A	C	M-M-L	A-L-O	Y	L
Stream Channel Reference Sites: An Illustrated Guide to Field Technique. USDA Forest Service, 1994. Ft. Collins, CO (26)	C	D	H-H-H	I-N-O	Y	H
Stream Corridor Assessment - Draft Survey Protocols . K. Yetman, Maryland Department of Natural Resources, 1999. Annapolis, MD (26)	C,R,A	C	M-M-L	I/A-L-O	N	L
Stream Inventory Handbook - Level I and II. USDA Forest Service, 1996. Version 9.6. Portland, OR (27)	C,R,A	D	M-M-H	I-N-O	O	H
Streamkeeper's Field Guide - Watershed Inventory and Stream Monitoring Methods. The Adopt-A-Stream Foundation, 1996. Everett, WA (27)	C,R,A,W	D	M-M-M	I/A-L/N-O	Y	M/H
Stream Visual Assessment Protocol. USDA Natural Resources Cons. Service, 1998. Portland, OR (28)	C,R,W,A	C	M-M-L	A-L-O	N	L

Column notes:

1) ***Primary Setting (listed first):*** **C**hannel-floodplain, **R**iparian area, **W**ater Quality, **A**quatic
2) ***Sampling Intensity:*** **C**ursory, **D**etailed
3) ***Skill Level, Training, Time (each rated as):*** **H**igh, **M**edium, **L**ow
4) ***Kind:*** **I**nventory, **A**ssessment; ***Measure Type:*** Qua**L**itative, Qua**N**titative; ***Proximity:*** **O**nsite, **R**emote
5) ***Reference Site Required:*** **Y**es, **N**o, **O**ptional
6) ***Suitability for Monitoring:*** **H**igh, **M**edium, **L**ow

Table (continued).

Column notes listed below .>	1	2	3	4	5	6
Technique **(to obtain a technique's citation and summary, turn to the page number listed in parentheses)**	**Primary Setting (listed first)**	**Sampling Intensity**	**Skill Level, Training, Time**	**Kind, Measure Type, Proximity**	**Reference Site Needed**	**Suitability for Monitoring**
***Primary Setting* - Riparian area**						
Guidebook for Application of Hydrogeomorphic Assessments to Riverine Wetlands. U.S. Army Corps of Engineers, Waterways Exp. Station, 1995. Washington, DC (15)	R	D	H-H-H	A-L/N-O	Y	M
Integrated Riparian Evaluation Guide. USDA Forest Service, 1992. Ogden, UT (16) **(Level I)** **(Level II)** **(Level III)**	 R,C,A R,C,A R,A	 C D D	 M-M-L H-H-M H-H-H	 I-L-R I/A-N-O I/A-N-O	 N N N	 L H H
Methods for Evaluating Riparian Habitats with Applications to Management. USDA Forest Service, 1987. Ogden, UT (17)	R,C	D	H-H-H	A-N-O	N	H
National Forestry Manual; National Range and Pasture Handbook - Procedures for completing Vegetation Field Forms and Ecological Sites. USDA Natural Resources Conservation Service, Washington, DC (18)	R	D	M-H-H	I-N-O	Y	M
Preliminary Investigation (PI) for Stream Riparian Areas. USDA Natural Resources Conservation Service, Watershed Science Institute, 1996. Seattle, WA (18)	R,C,A,W	C	M-M-L	I-L/N-O	N	L
Protocols for Classifying, Monitoring, and Evaluating Stream/Riparian Vegetation on Idaho Rangeland Streams. Division of Environmental Quality, 1992. Boise, ID (19)	R	D	H-H-H	I-N-O	N	H
Rapid Assessment of Riparian Systems (RARS). R.D. Ohmart et al., 1998. Arizona Game and Fish Department, Phoenix, AZ (20)	R,C	D	M-H-H	A-N-O/R	Y	M

Column notes:

1) ***Primary Setting (listed first):*** **C**hannel-floodplain, **R**iparian area, **W**ater Quality, **A**quatic
2) ***Sampling Intensity:*** **C**ursory, **D**etailed
3) ***Skill Level, Training, Time (each rated as):*** **H**igh, **M**edium, **L**ow
4) ***Kind:*** **I**nventory, **A**ssessment; ***Measure Type:*** Qua**L**itative, Qua**N**titative; ***Proximity:*** **O**nsite, **R**emote
5) ***Reference Site Required:*** **Y**es, **N**o, **O**ptional
6) ***Suitability for Monitoring:*** **H**igh, **M**edium, **L**ow

Table (continued).

Column notes listed below >	1	2	3	4	5	6
Technique (to obtain a technique's citation and summary, turn to the page number listed in parentheses)	Primary Setting (listed first)	Sampling Intensity	Skill Level, Training, Time	Kind, Measure Type, Proximity	Reference Site Needed	Suitability for Monitoring
***Primary Setting* - Riparian area (con't)**						
Riparian Area Management: A User Guide to Assessing Proper Functioning Condition and the Supporting Science for Lotic Areas. USDI Bureau of Land Management, 1998. Denver, CO (22)	R,C	C	M-L-L	A-L-O	Y	L
Riparian Area Management - Greenline Riparian-Wetland Monitoring. USDI Bureau of Land Management, 1993. Denver, CO (22)	R	D	M-M-M	I-N-O	N	H
Riparian Area Management - Inventory and Monitoring of Riparian Areas. USDI Bureau of Land Management, 1989. Denver, CO (23)	R	D	M/L-H/M/L-H/M/L	I-N-O	N	H
Riparian Area Management - Procedures for Ecological Site Inventory. USDI Bureau of Land Management, 1992. Denver, CO (23)	R,C	D	H-H-H	I-N-O	Y	L
Riparian Area Management - Using Aerial Photographs to Assess Proper Functioning Condition of Riparian-Wetland Areas. USDI Bureau of Land Management, 1996. Denver, CO (24)	R,C	C	M-M-L	A-L-R	Y	L
Riparian Reserve Evaluation Techniques and Synthesis in Ecosystem Analysis at the Watershed Scale - Federal Guide for Watershed Analysis, Section II. Multi-agency, 1995. Portland, OR (24)	R	D	H-M-H	A-L-O/R	N	M
Role of GIS in Selecting Sites for Riparian Restoration Based on Hydrology and Land Use. Utah State University, 1997. Logan, UT (25)	R	C	H-M-L	I/A-N-R	Y	M
RWRP Lotic Health Assessment. University of Montana, 1999. Missoula, MT (25)	R,C	C	M-L-L	A-L-O	N	M
Technology Policy Paper - Mapping Procedures for Riparian and Other Small Areas. USDA Natural Resources Conservation Service. 1997. Wash., DC (29)	R,C	D	H-M-M	I-L/N-O	N	L

Column notes:

1) ***Primary Setting (listed first):*** **C**hannel-floodplain, **R**iparian area, **W**ater Quality, **A**quatic
2) ***Sampling Intensity:*** **C**ursory, **D**etailed
3) ***Skill Level, Training, Time (each rated as):*** **H**igh, **M**edium, **L**ow
4) ***Kind:*** **I**nventory, **A**ssessment; ***Measure Type:*** Qua**L**itative, Qua**N**ttitative; ***Proximity:*** **O**nsite, **R**emote
5) ***Reference Site Required:*** **Y**es, **N**o, **O**ptional
6) ***Suitability for Monitoring:*** **H**igh, **M**edium, **L**ow

Table (continued).

Column notes listed below >	1	2	3	4	5	6
Technique **(to obtain a technique's citation and summary, turn to the page number listed in parentheses)**	**Primary Setting (listed first)**	**Sampling Intensity**	**Skill Level, Training, Time**	**Kind, Measure Type, Proximity**	**Reference Site Needed**	**Suitability for Monitoring**
***Primary Setting* - Water quality**						
Adopt-a-Stream Shoreline Survey. Massachusetts Riverways Programs, 1996. Boston, MA (13)	W,C,R,A	C	L-M-M	I/A-L-O	N	L
Agricultural Water Quality Index. Robert B. Annis Water Resources Institute, Grand Valley State University, 1998. Allendale, MI (13)	W,R,C,A	C	M-M-M	A-L-O	N	L
Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. U.S. Environmental Protection Agency, 19--. Seattle, WA (17)	W,A,C,R	D	M-H-H	A-N-O	Y	H
Stream Temperature Investigations: Field and Analytic Methods (for use with SNTEMP: Stream Network Temperature Model). U.S. Fish and Wildlife Service, 1989. Ft. Collins, CO (28)	W (tempera-ture)	D	H-M-M	I-N-O	N	H
Water Quality Indicators Guide - Surface Water (Chapter 2 and Appendices A and F). Terrene Institute, 1996. Washington, DC (30)	W	C	M-M-M	A-L-O	N	L

Column notes:

1) ***Primary Setting (listed first):*** **C**hannel-floodplain, **R**iparian area, **W**ater Quality, **A**quatic
2) ***Sampling Intensity:*** **C**ursory, **D**etailed
3) ***Skill Level, Training, Time (each rated as):*** **H**igh, **M**edium, **L**ow
4) ***Kind:*** **I**nventory, **A**ssessment; ***Measure Type:*** Qua**L**itative, Qua**N**ttitative; ***Proximity:*** **O**nsite, **R**emote
5) ***Reference Site Required:*** **Y**es, **N**o, **O**ptional
6) ***Suitability for Monitoring:*** **H**igh, **M**edium, **L**ow

Table (continued).

Column notes listed below >	1	2	3	4	5	6
Technique **(to obtain a technique's citation and summary, turn to the page number listed in parentheses)**	**Primary Setting (listed first)**	**Sampling Intensity**	**Skill Level, Training, Time**	**Kind, Measure Type, Proximity**	**Reference Site Needed**	**Suitability for Monitoring**
***Primary Setting* - Aquatic habitat**						
Fish and Fish Habitat Standard Inventory Procedures Handbook (R1/R4 - Northern/ Intermountain Regions). USDA Forest Service, 1997. Ogden, UT (15)	A,C,W-temp.	D	M-H-H	I-L/N-O	O	M
Qualitative Habitat Evaluation Index [QHEI]: Rationale, Methods, and Application. State of Ohio Environmental Protection Agency, 1989. Columbus, OH (20)	A,W	D	H-H-H	I/A-L/N-O	Y	M
Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers - Periphyton, Benthic Macroinvertebrates and Fish. U.S. Environmental Protection Agency, 1999. Washington, DC (21)	A,W,C	D	M-H-H	I/A-L/N-O	Y	M
Underwater Methods for Study of Salmonids in the Intermountain West. USDA Forest Service, Intermountain Research Station, 1994. Ogden, UT (29)	A	D	M-M-H	I-N-O	O	H

Column notes:

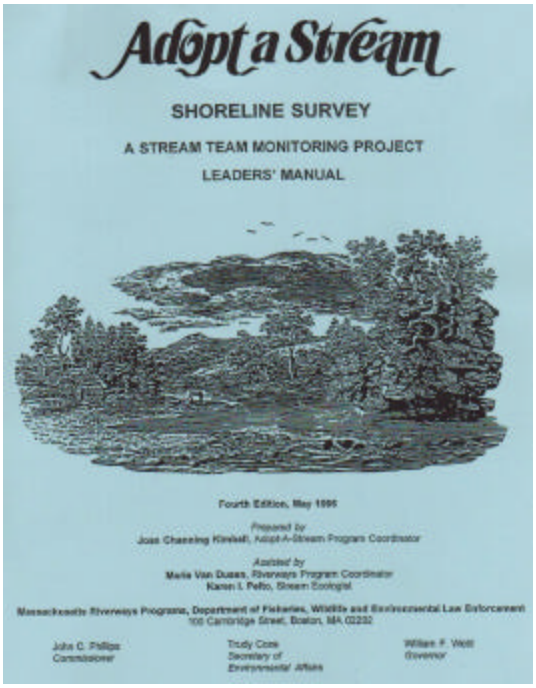
1) ***Primary Setting (listed first):*** **C**hannel-floodplain, **R**iparian area, **W**ater Quality, **A**quatic
2) ***Sampling Intensity:*** **C**ursory, **D**etailed
3) ***Skill Level, Training, Time (each rated as):*** **H**igh, **M**edium, **L**ow
4) ***Kind:*** **I**nventory, **A**ssessment; ***Measure Type:*** Qua**L**itative, Qua**N**titative; ***Proximity:*** **O**nsite, **R**emote
5) ***Reference Site Required:*** **Y**es, **N**o, **O**ptional
6) ***Suitability for Monitoring:*** **H**igh, **M**edium, **L**ow

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Adopt-a-Stream Shoreline Survey. Massachusetts Riverways Programs, 1996. J.C. Kimball and M. Van Dusen. Depart of Fisheries, Wildlife and Environmental Law Enforcement, 100 Cambridge St., Boston, MA 02202

Summary: *The survey's purpose is to help local "stream teams" determine vital signs of a river or stream, report immediate problems to proper authorities, and prioritize both short term and long range work. The water course is divided into reasonably sized segments that can be walked or canoed. Field data sheets include measurement of instream conditions, stream vegetation, streambank and corridor conditions, and presence of observable fish and wildlife species. Other data sheets include a summary sheet for a segment or reach survey, a pipe survey, a bridge survey, and a wetlands survey.*

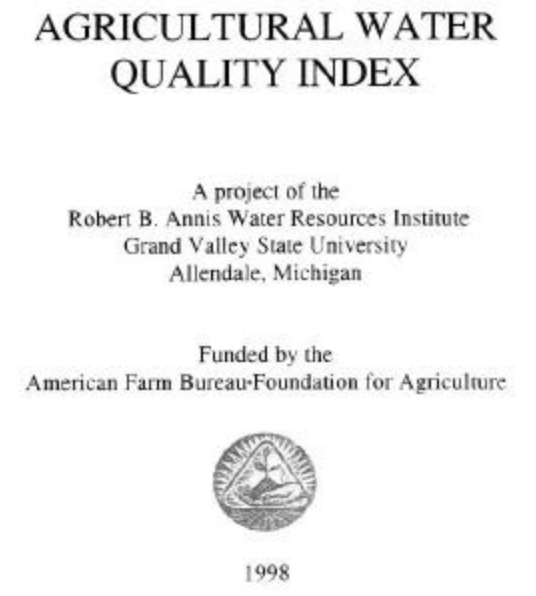
62 pages, illustrated



Agricultural Water Quality Index. Robert B. Annis Water Resources Institute, 1998. Grand Valley State University, J. Cooper et al, WRI Publication #MR-98-1, One Campus Drive, Allendale, MI 49401

Summary: *The Agricultural Water Quality Index (AWQI) is an assessment protocol that is specifically designed to evaluate the relationship between agricultural operations and water quality in agroecosystems. The AWQI is based on a series of assessments which can be examined separately and accumulated into a total score. Individual assessments include "Riparian Zone" metrics (width, completeness, vegetation types, summary), "Stream Channel" metrics (flow status, flow stability, channel sinuosity, channel structure, summary), and, optionally, a "Benthic Macroinvertebrates" metric (population diversity including indicator types). Specific recommendations for land and water management are associated with the ranked levels of individual metrics. Worksheets and scoring tables are provided.*

75 pages



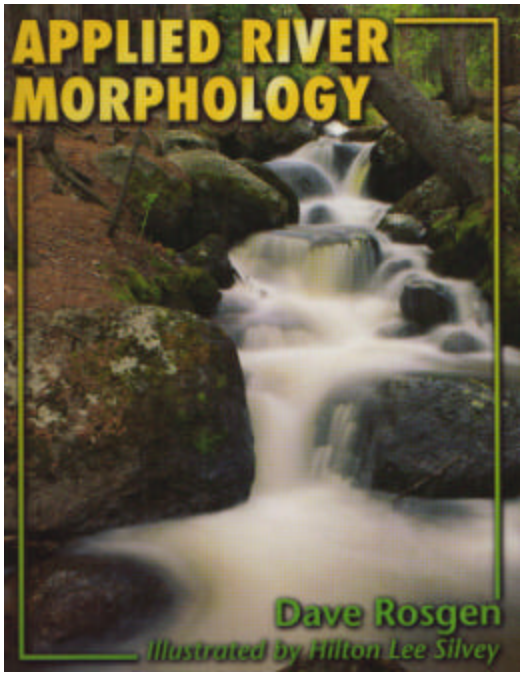
SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Applied River Morphology. Wildland Hydrology Consultants, 1996. D. Rosgen, 1481 Stevens Lake Road, Pagosa Springs, CO 81147

Summary: *The guide book includes fundamental principles of river behavior, a hierarchical stream inventory and a classification of natural rivers with illustrations, data summaries and photographs depicting major stream types. The book contains field techniques and forms for:*

-Stream classification of a reference reach
-Bank erosion prediction
-Fish habitat structure evaluation
-Sediment relations
-Hydraulics
-Channel stability evaluations

341 pages, illustrated



Channel-Reach Morphology in Mountain Drainage Basins. Geological Society of America Bulletin, Volume 109, p. 596-611, 1997. D.R. Montgomery and J.M. Buffington, Department of Geological Sciences; request from the Geological Society of America, P.O. Box 9140, Boulder, CO 80301-9140

Summary: *A classification of channel-reach morphology in mountain drainage basins synthesizes stream morphologies into seven distinct reach types: colluvial, bedrock, and five alluvial channel types (cascade, step pool, plane bed, pool riffle, and dune ripple). Coupling reach-level channel processes with the spatial arrangement of reach morphologies, their links to hillslope processes, and external forcing by confinement, riparian vegetation, and woody debris defines a process-based framework within which to assess channel condition and response potential in mountain drainage basins. The classification is broadly applicable with its primary advantage of addressing the role of large woody debris.*

15 pages, illustrated


Channel-reach morphology in mountain drainage basins

David R. Montgomery* and John M. Buffington† — *Department of Geological Sciences, University of Washington*

ABSTRACT

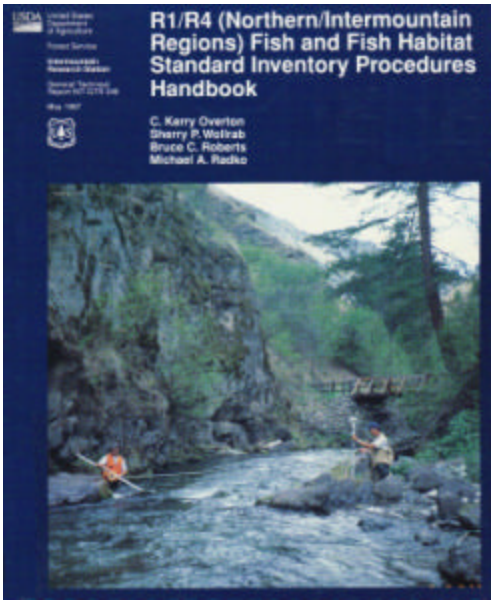
A classification of channel-reach morphology in mountain drainage basins synthesizes stream morphologies into seven distinct reach types: colluvial, bedrock, and five alluvial channel types (cascade, step pool, plane bed, pool riffle, and dune ripple). Coupling reach-level channel processes with the spatial arrangement of reach morphologies, their links to hillslope processes, and external forcing by confinement, riparian vegetation, and woody debris defines a process-based framework within which to assess channel condition and response potential in mountain drainage basins. Field investigations demonstrate characteristic slope, grain size, shear stress, and roughness ranges for different reach types, observations consistent with our hypothesis that alluvial channel morphologies reflect specific roughness configurations adjusted to the relative magnitudes of sediment supply and transport capacity. Steep alluvial channels (cascade and step pool) have high ratios of transport capacity to sediment supply and are resilient to changes in discharge and sediment supply, whereas low-gradient alluvial channels (pool riffle and dune ripple) have lower transport capacity to supply ratios and thus exhibit significant and prolonged response to changes in sediment supply and discharge. General differences in the ratio of transport capacity to supply between channel types allow aggregation of reaches into source, transport, and response segments, the spatial distribution of which provides a watershed-level conceptual model linking reach morphology and channel processes. These two scales of channel network classification define a framework within which to investigate spatial and temporal patterns of channel response in mountain drainage basins.

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Fish and Fish Habitat Standard Inventory Procedures Handbook (R1/R4 - Northern/ Intermountain Regions). USDA Forest Service, 1997. Intermountain Research Station, 324 25th Street, Ogden, UT 84401

Summary: *The handbook describes the standard inventory procedures for collecting fish habitat and salmonid fish species data for streams managed by the Northern Region (R1) and Intermountain Region (R4) of the Forest Service. The inventory defines the structure (pool/riffle, forming features), pattern (sequence and spacing) and dimensions (length, width, depth, area, volume, and so forth) of fish habitat; describes species composition, distribution, and relative abundance of salmonid species; and facilitates the calculation of summary statistics for habitat descriptors. The handbook is illustrated in color and includes data collection forms.*

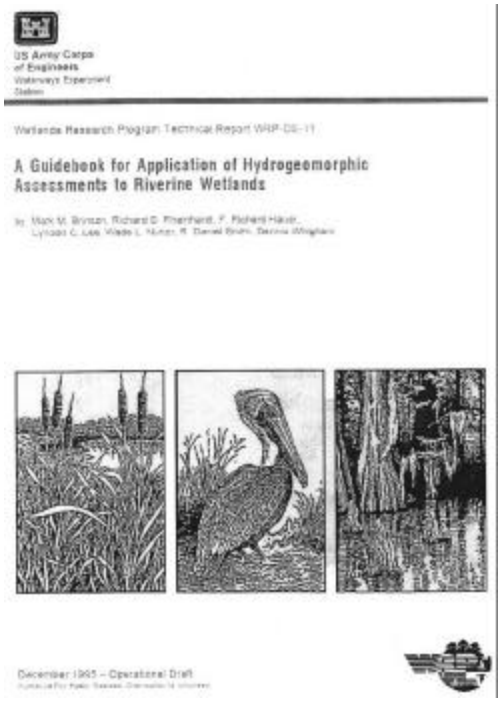
73 pages, illustrated



Guidebook for Application of Hydrogeomorphic Assessments to Riverine Wetlands. U.S. Army Corps of Engineers, Waterways Exp. Station, 1995. Technical Report WRP-DE-11. M. Brinson et al. Washington, DC 20314-1000

Summary: *The guidebook provides the basis (or template) for applying the hydrogeomorphic (HGM) approach for specific physiographic regions for wetland functional assessment of riverine wetlands in context with the Clean Water Act Section 404 Regulatory Program. The concept of a "reference standard" is used, i.e., conditions exhibited by a group of reference wetlands in a physiographic region that correspond to the highest level of functioning. Fifteen functions are identified for the riverine wetland class and are valuated by an index computed using equations of selected variables from a group of 44 variables. Generic equations, detailed information, and field tally sheets are provided to document functions and develop models for a specific regional riverine subclass.*

207 pages, illustrated

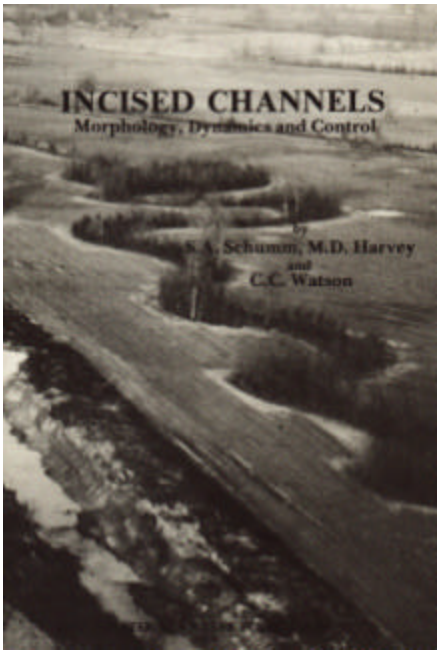


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Incised Channels - Morphology, Dynamics and Control. S.A. Schumm, M.D. Harvey, and C.C. Watson, 1984. Water Resources Publications, P.O. Box 2841, Littleton, Co 80161

Summary: *The original basis of the document was a report on the geomorphic characteristics of channelized streams in northern Mississippi to determine if their future behavior could be predicted. The publication contains a literature review on incised channels, historical information on subject channels, and discussion of geomorphic evolution of incised channels. The concept of entrenched streams is introduced in chapter 5 of the document including the hypothetical sequence of arroyo evolution. A summary of incised channels is listed in chapter 7 including a discussion of a possible evolutionary sequence.*

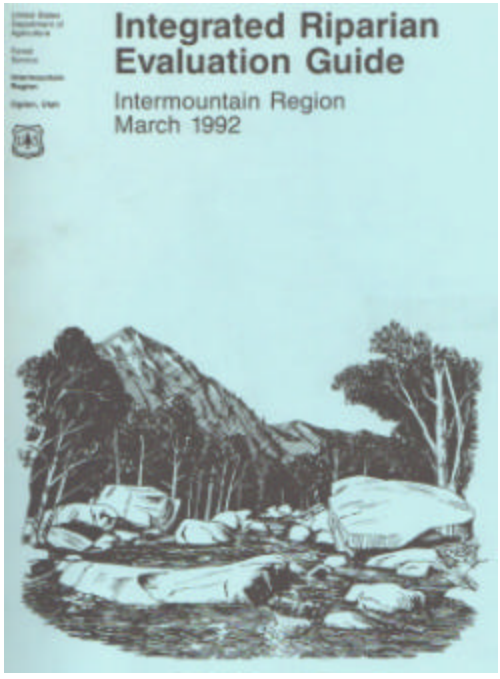
200 pages, illustrated



Integrated Riparian Evaluation Guide (Levels I, II, and III). USDA Forest Service, 1992. T. Collins, Regional Soil Scientist, et al. Regional Office, Intermountain Region, 324 25th Street, Ogden, UT 84401

Summary: *The guide provides an integrated approach for: A) Stratifying and classifying riparian areas according to their natural inherent characteristics, and their respective existing conditions; B) Data collection; C) Evaluation of riparian areas; D) Future development and linkage of a riparian data base; E) Preparation of a written narrative to interpret the data and suggest management applications; F) Providing a process to prioritize or rank riparian areas based on management objectives; G) Strengthening the riparian management implications of the Forest Land Management Plan. The approach is split into threes levels: level I is an office procedure, level II is a field procedure, and level III is a more quantitative, site-specific field data collection. Levels are progressive and should be completed in order. The guide includes data collection forms.*

60+ pages, illustrated

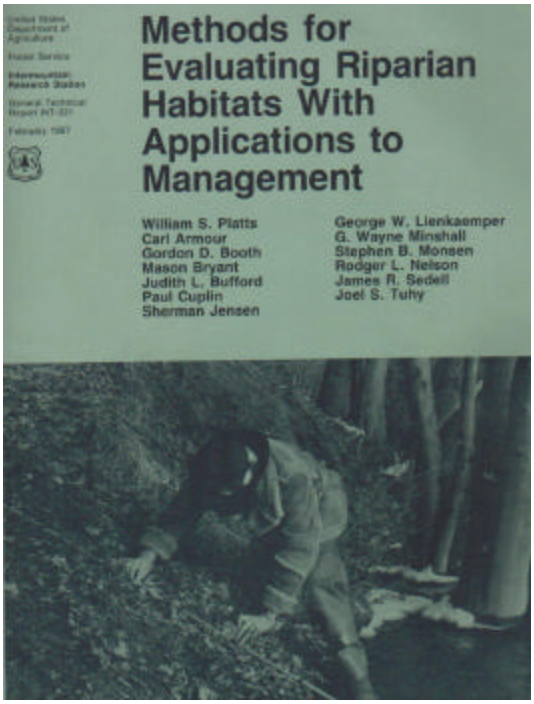


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Methods for Evaluating Riparian Habitats with Applications to Management. USDA Forest Service, 1987. General Technical Report INT-221. Intermountain Research Station, W. Platts et al, 324 25th Street, Ogden, UT 84401

Summary: *The report compiles a comprehensive set of methods for resource specialists to use in managing, evaluating and monitoring riparian conditions adjacent to streams, lakes, ponds and reservoirs with an emphasis on streams. Issues of sampling kind and intensity, accuracy and precision are discussed. Detailed procedures are given for measuring vegetation, classifying riparian communities and soils, using remote sensing, measuring water column attributes, detecting streambank morphology and alteration, mapping woody debris, using benthic macroinvertebrates, and evaluating historic riparian habitats. Emphasis is on procedural details rather than reliance on pre-defined data collection forms.*

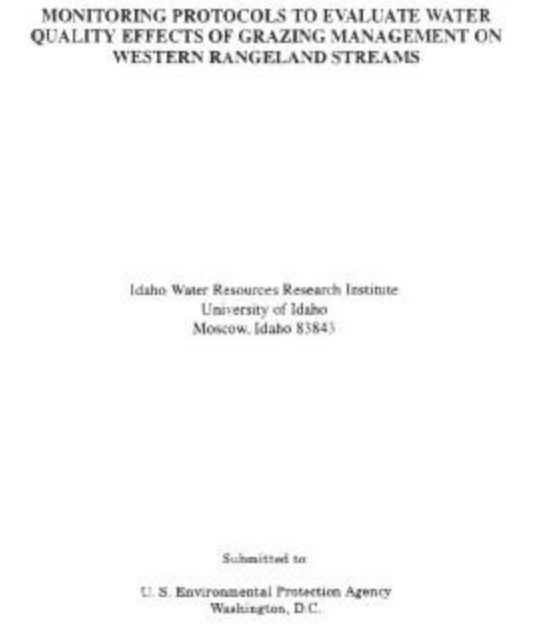
177 pages, illustrated



Monitoring Protocols to Evaluate Water Quality Effects of Grazing Management on Western Rangeland Streams. U.S. Environmental Protection Agency, 1993. Water Division. Region 10, 1200 Sixth Avenue, Seattle, WA 98101

Summary: *The document describes a monitoring system to assess grazing impacts on water quality in streams of the western United States. Methods discussed are reportedly easy to use and cost-effective (reduced sampling frequency, limited need for specialized equipment, and limited laboratory analyses). The protocols focus on attributes of the stream channel, stream bank, and streamside vegetation (characteristics are sampled during low flow summer conditions). Methodology requires an interdisciplinary team. Explanatory illustrations and various field data collection forms are included.*

179 pages, illustrated


MONITORING PROTOCOLS TO EVALUATE WATER QUALITY EFFECTS OF GRAZING MANAGEMENT ON WESTERN RANGELAND STREAMS

Idaho Water Resources Research Institute
University of Idaho
Moscow, Idaho 83843

Submitted to

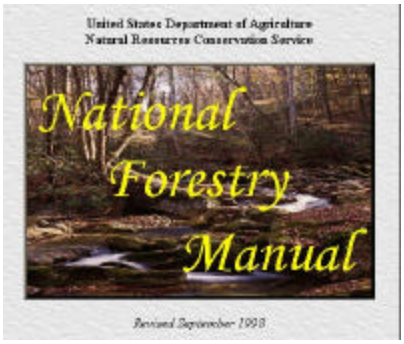
U. S. Environmental Protection Agency
Washington, D.C.

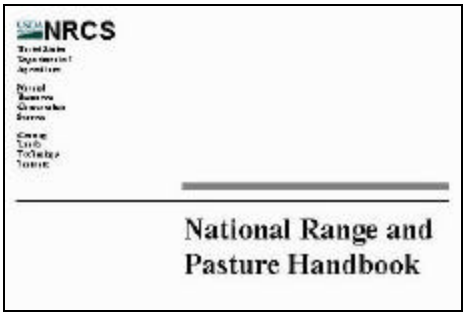
SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

National Forestry Manual; National Range and Pasture Handbook (Procedures for completing Vegetation Field Forms and Ecological Sites.) USDA Natural Resources Conservation Service (NRCS), 1998, 1997. P.O. Box 2890, Washington, DC 20013

Summary: *The manual and handbook contain detailed procedures for completing vegetation field forms and ecological sites. The* ***National Forestry Manual*** *is applicable to stream riparian areas that are currently forested or have a potential for a plant community dominated by woody plants (trees) with a height potential of at least 4 meters. The* ***National Range and Pasture Handbook*** *is applicable to stream riparian areas that are currently in herbaceous or shrub vegetation or have a potential for a plant community dominated by herbaceous or shrub species. Detailed instructions, coding conventions and data collection forms are provided in both the manual and handbook. Collected field data and information may be entered into a national database maintained and supported by the NRCS.*

100+ pages each, illustrated





Preliminary Investigation (PI) for Stream Riparian Areas. USDA Natural Resources Conservation Service, Watershed Science Institute, 1996. c/o GEO SCI, Box 351310, UW, Seattle, WA 98195-1310

Summary: *This technique is a single page form that permits the user to record major attributes of a representative segment of a stream reach. It was developed for use with private landowners to focus attention on the existing conditions of their streams. Basic stream attributes (e.g., stream order, depth, width, gradient, entrenchment), soil conditions (e.g., bank erosion frequency, bedload fine sediments, upper bank compaction), water conditions (e.g., turbidity, presence of algae, color, temperature), plants (e.g., potential native vegetation, present vegetation, dominant terrestrial plants, aquatic species), air condition, animals (e.g., fish species, aquatic macroinvertebrates, land species), and human use attributes are collected.*

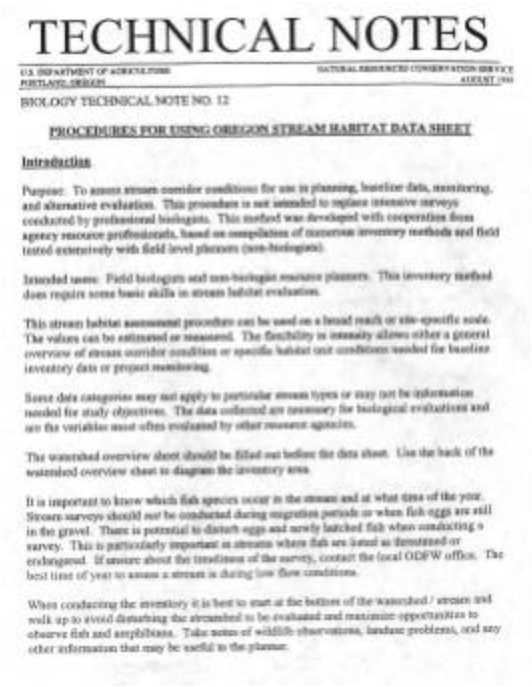
2 pages

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Procedures for Using [the] Oregon Stream Habitat Data Sheet. USDA Natural Resources Conservation Service, 1998. Biology Technical Note No. 12, 101 SW Main Street, Suite 1300, Portland, OR 97204-3221

Summary: *The assessment procedure can be used on a broad reach or site-specific scale. Values that are entered on the data sheet can be estimated or measured. The intended use is for planning, baseline data, monitoring, and evaluating restoration alternatives. The procedure is not intended to replace intensive surveys conducted by professional biologists. Users of the procedure are encouraged to complete the watershed overview sheet before the habitat data sheet. The data sheet accommodates entries to identify the site, substrate composition, and bank vegetation. A series of criteria tables are used to assess and score stream habitat condition..*

12 pages, illustrated



TECHNICAL NOTES

U.S. DEPARTMENT OF AGRICULTURE — NATURAL RESOURCES CONSERVATION SERVICE
PORTLAND, OREGON — AUGUST 1998

BIOLOGY TECHNICAL NOTE NO. 12

PROCEDURES FOR USING OREGON STREAM HABITAT DATA SHEET

Introduction

Purpose: To assess stream corridor conditions for use in planning, baseline data, monitoring, and alternative evaluation. This procedure is not intended to replace intensive surveys conducted by professional biologists. This method was developed with cooperation from agency resource professionals, based on compilation of numerous inventory methods and field tested extensively with field level planners (non-biologists).

Intended users: Field biologists and non-biologist resource planners. This inventory method does require some basic skills in stream habitat evaluation.

This stream habitat assessment procedure can be used on a broad reach or site-specific scale. The values can be estimated or measured. The flexibility in intensity allows either a general overview of stream corridor condition or specific habitat unit conditions needed for baseline inventory data or project monitoring.

Some data categories may not apply to particular stream types or may not be information needed for study objectives. The data collected are necessary for biological evaluations and are the variables most often evaluated by other resource agencies.

The watershed overview sheet should be filled out before the data sheet. Use the back of the watershed overview sheet to diagram the inventory area.

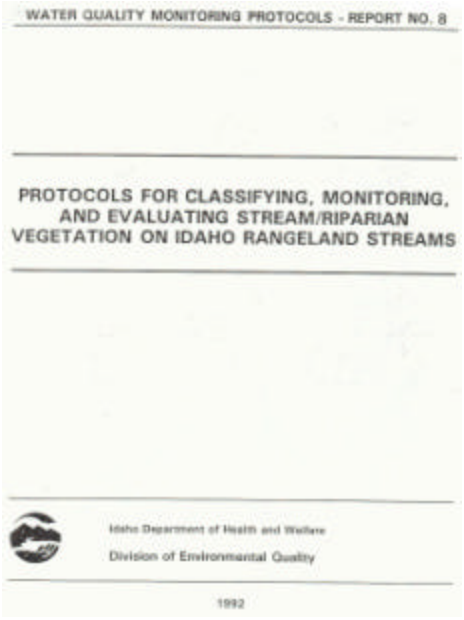
It is important to know which fish species occur in the stream and at what time of the year. Stream surveys should *not* be conducted during migration periods or when fish eggs are still in the gravel. There is potential to disturb eggs and newly hatched fish when conducting a survey. This is particularly important in streams where fish are listed as threatened or endangered. If unsure about the timeliness of the survey, contact the local ODFW office. The best time of year to assess a stream is during low flow conditions.

When conducting the inventory it is best to start at the bottom of the watershed / stream and walk up to avoid disturbing the streambed to be evaluated and maximize opportunities to observe fish and amphibians. Take notes of wildlife observations, landuse problems, and any other information that may be useful to the planner.

Protocols for Classifying, Monitoring, and Evaluating Stream/Riparian Vegetation on Idaho Rangeland Streams. Division of Environmental Quality, 1992. Report No. 8. Idaho Department of Health and Welfare, E. Cowley. 1410 North Hilton, Boise, ID 83720-9000

Summary: *The document defines protocols and procedures for evaluating streamside vegetation and streambank stability for Idaho's small (usually less than 30 feet wide) rangeland streams. It also provides protocols for monitoring stream canopy cover, streambank stability, solar input, and establishing permanent photo points associated with livestock grazing and other activities that affect streamside vegetation and beneficial uses of water. The protocols are directed at 3 important pollutant sources affecting the biological integrity of streams and lakes that may result from livestock grazing: 1) streambank erosion, 2) water temperature, and 3) vegetation.*

37+ pages, illustrated



WATER QUALITY MONITORING PROTOCOLS - REPORT NO. 8

PROTOCOLS FOR CLASSIFYING, MONITORING, AND EVALUATING STREAM/RIPARIAN VEGETATION ON IDAHO RANGELAND STREAMS

Idaho Department of Health and Welfare
Division of Environmental Quality

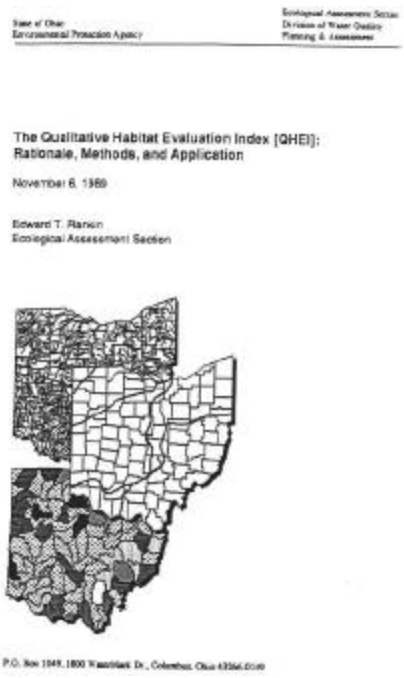
1992

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Qualitative Habitat Evaluation Index [QHEI]: Rationale, Methods, and Application. State of Ohio Environmental Protection Agency, 1989. Edward T. Rankin, Ecological Assessment Section, P.O. Box 1049, 1800 WaterMark Dr., Columbus, OH 43266-0149

Summary: *The index is designed to provide a measure of habitat generally corresponding to those physical factors that affect fish communities and which are generally important to other aquatic life, such as invertebrates. The field sheet for the QHEI consists of qualitative descriptors that are checked as appropriate. Highest scores are assigned to the habitat parameters that have been shown to be correlated with streams having high biological diversity and integrity, with progressively lower scores assigned to less desirable habitat features. Individual scores are provided for the habitat components of substrate, instream cover, riparian zone and bank erosion, pool/glide quality, riffle/run quality and gradient. A total score of 100 is possible.*

51 pages



The Qualitative Habitat Evaluation Index [QHEI]:
Rationale, Methods, and Application

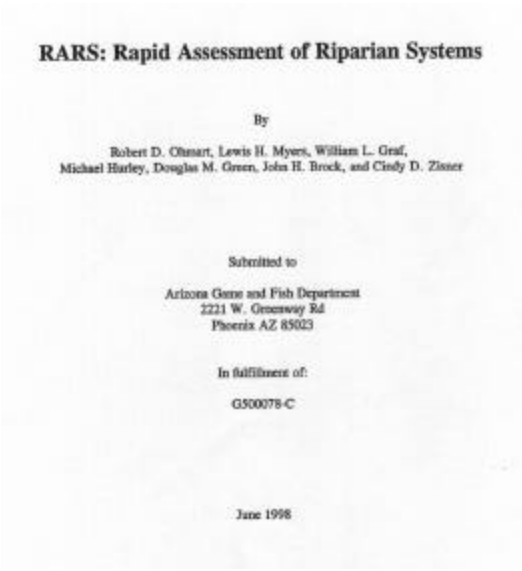
November 6, 1989

Edward T. Rankin
Ecological Assessment Section

Rapid Assessment of Riparian Systems (RARS) - Draft Report. R.D. Ohmart et al., 1998. Arizona Game and Fish Department, 2221 W. Greenway Road, Phoenix, AZ 85023

Summary: *The assessment was developed to have a tool more applicable to streams in Arizona than those currently being used throughout the West. The technique addresses riparian area classification, channel geomorphology, riparian functional analysis procedure, and riparian monitoring with photography. The objective of the developers was to collect quantitative field data to document and defend functional interpretations. The Tonto National Forest approach (Tonto Riparian Inventory and Monitoring Methods or TRIMM) was the working model for developing the assessment. The Arizona Game and Fish Department can be contacted for the final report and assessment procedure.*

130 pages



RARS: Rapid Assessment of Riparian Systems

By

Robert D. Ohmart, Lewis H. Myers, William L. Graf,
Michael Harley, Douglas M. Green, John H. Brock, and Cindy D. Zisner

Submitted to

Arizona Game and Fish Department
2221 W. Greenway Rd
Phoenix AZ 85023

In fulfillment of:

G500078-C

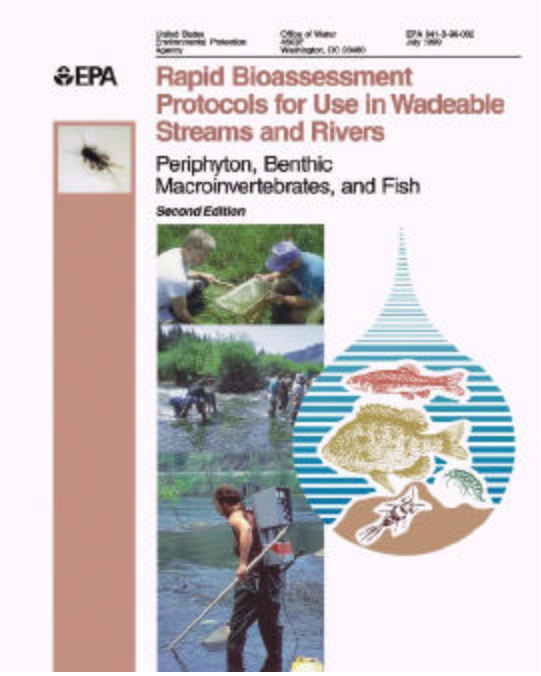
June 1998

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers - Periphyton, Benthic Macroinvertebrates, and Fish. Second Edition. U.S. Environmental Protection Agency, 1999. Office of Water (4503F), EPA841-B-99-002. J. Plafkin et al, Assessment and Watershed Protection Division, 401 M Street SW, Washington, DC 20460

Summary: *The document provides states with a practical technical reference for conducting cost-effective biological assessments of lotic systems. The protocols were designed as inexpensive screening tools to determine if a stream is supporting or not supporting a designated aquatic life use. They may also be appropriate for priority setting, point and nonpoint-source evaluations, use attainability analyses and trend monitoring. Worksheets are included. The protocols must be locally adapted and scaled.*

104 pages, illustrated



Rapid Stream Assessment Protocol (RSAT) Field Methods - Appendix A. J. Galli, Sr., 1996. Dept. of Environmental Programs, Metropolitan Washington Council of Governments, 777 North Capitol St. NE, Washington, DC 20002

Summary: *The protocol is a synthesis of several techniques with applicability to non-limestone Piedmont streams with drainage areas less than 150 square miles. RSAT employs both a reference stream and an integrated numerical scoring and verbal ranking approach. Evaluation categories include: 1) Channel stability, 2) Channel scouring/sediment deposition, 3) Physical instream habitat, 4) Water quality, 5) Riparian habitat conditions, and 6) Biological indicators (macroinvertebrates). Parameters are measured at approximately 400-foot intervals along the stream. Data is first recorded via field survey sheets and later transferred into a spreadsheet data base.*

35 pages, illustrated


Appendix A
Final Technical Memorandum:
Rapid Stream Assessment Technique
(RSAT) Field Methods

Prepared For:
Montgomery County Department of Environmental Protection
Division of Water Resources Management
Montgomery County, Maryland

Prepared By:
John Galli, Sr. Environmental Engineer

Department of Environmental Programs
Metropolitan Washington Council of Governments
777 North Capitol St, NE
Washington, DC 20002

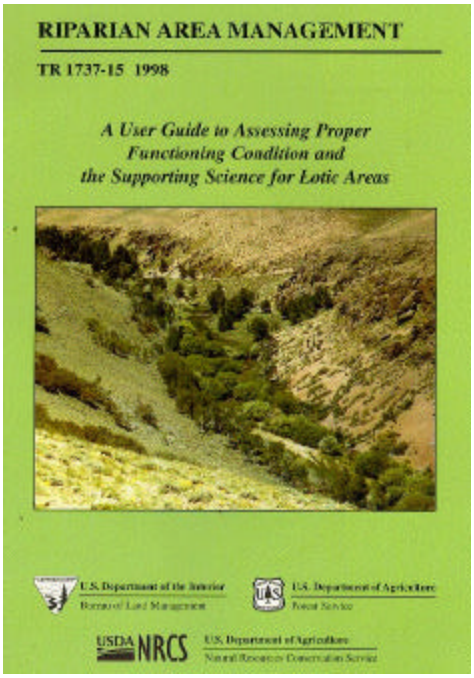
July, 1996

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Riparian area management: a user guide to assessing proper functioning condition and the supporting science for lotic areas. USDI Bureau of Land Management, 1998. TR 1737-15. P.O. Box 25047, Denver, CO 80225

Summary: *The guide establishes a method for evaluating the condition of riparian-wetland lotic areas and classifying segments or reaches of streams into Proper Functioning Condition (PFC), Functional-At Risk, Nonfunctional, and Unknown categories. The qualitative, yet science-based process, considers both abiotic and biotic factors as they relate to physical function. A standard checklist of 17 key questions is provided and enables users to determine the functional condition of a stream reach or segment. PFC must be conducted by an interdisciplinary team trained and familiar with the local conditions being assessed. The supporting science and related quantitative methodologies for each of the 17 questions are provided.*

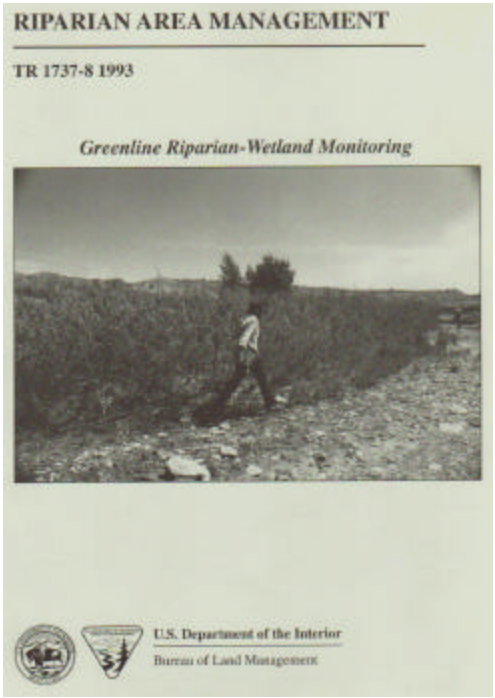
126 pages, illustrated



Riparian Area Management - Greenline Riparian-Wetland Monitoring. USDI Bureau of Land Management, 1993. TR 1737-8. National Applied Resources Sciences Center, P.O. Box 25047, Denver, CO 80225-0047

Summary: *The technical reference gives the detailed procedure for the greenline monitoring method. Greenline is a term used to essentially identify nearest-to-stream continuous riparian plant community types using a line intercept transect running parallel to the stream. It is a procedure that is both repeatable for monitoring purposes and a point of reference which minimizes problems associated with changing moisture gradient. Data collection forms are included. (Note: As of the date of this report, the USDA-Forest Service is in the process of updating the "greenline" methodology with plans to republish the technique as a Forest Service technical publication.)*

45 pages, illustrated

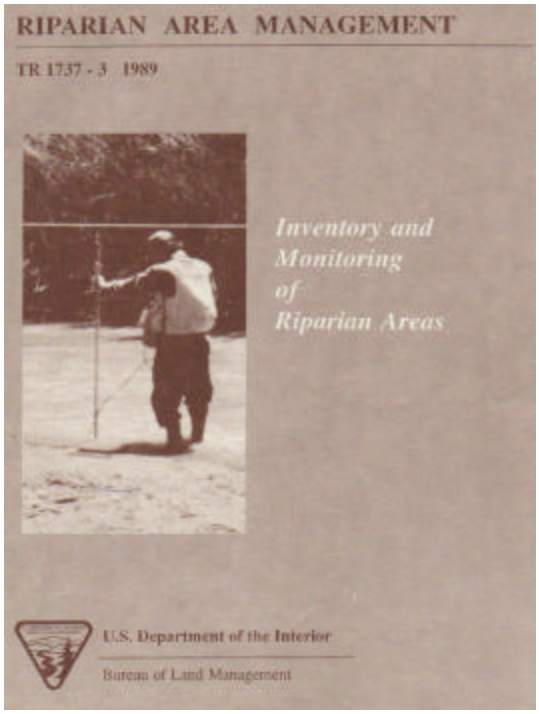


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Riparian Area Management - Inventory and Monitoring of Riparian Areas. USDI Bureau of Land Management, 1989. TR 1737-3. National Applied Resources Sciences Center, P.O. Box 25047, Denver, CO 80225-0047

Summary: *The technical reference contains suggested techniques and procedures for performing an extensive inventory and, if warranted, an intensive inventory. Extensive components include drainage pattern, landform, soils information, channel form and condition, vegetation types and ecological sites, floodplain characteristics and other attributes. Intensive components include detail soil characteristics and properties, channel parameters, vegetation identification and structure, woody species characteristics, and other attributes. A section on monitoring is integrated in the technical reference. Inventory forms are included.*

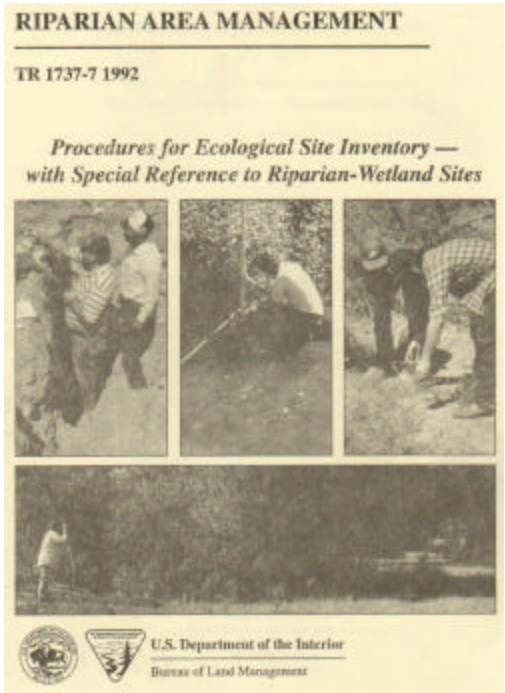
79 pages, illustrated



Riparian Area Management - Procedures for Ecological Site Inventory. USDI Bureau of Land Management, 1992. TR 1737-7. National Applied Resources Sciences Center, P.O. Box 25047, Denver, CO 80225-0047

Summary: *The technical reference provides detailed field procedures for describing and documenting riparian-wetland ecological sites (potential vegetation) which are a function of and defined by the interaction of soils, climate, hydrology, and vegetation at riparian-wetland sites. The document contains a "Standard Site Field Review Checklist," a "Site Correlation Checklist," a "Standard Site Description," and a completed, sample "Standard Site Description." The technical reference is intended for use with the National Range and Pasture Handbook, the National Forestry Manual and the National Soil Survey Handbook available from the USDA, Natural Resources Conservation Service, P.O. Box 2890, Washington, DC 20013.*

135 pages, illustrated

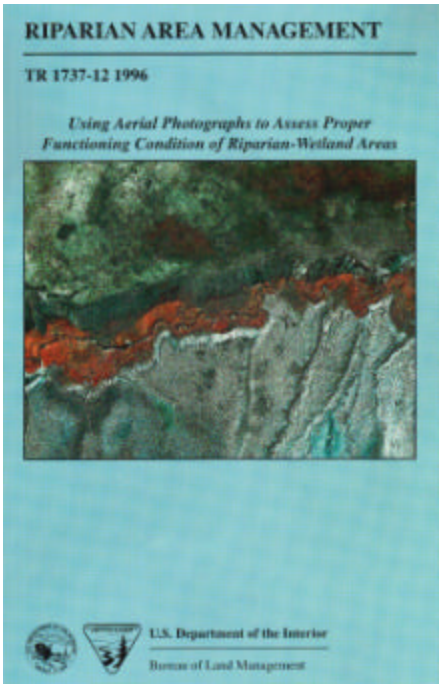


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Riparian Area Management - Using Aerial Photographs to Assess Proper Functioning Condition of Riparian-Wetland Areas. USDI Bureau of Land Management, 1996 (Revised 1999). TR 1737-12. P.O. Box 25047, Denver, CO 80225

Summary: *The document provides a procedure for using aerial photography to answer Proper Functioning Condition (PFC) checklist items. It supplements TR1737-15, Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lotic areas. The technical release gives the detailed procedure for gathering existing source material, analyzing equipment needs, defining reaches and areas, interpreting aerial photos, and verifying interpretations in the field. Also included are specific recommendations pertaining to needed aerial photo qualities, photo interpretation examples, and the results of large area case studies in Montana.*

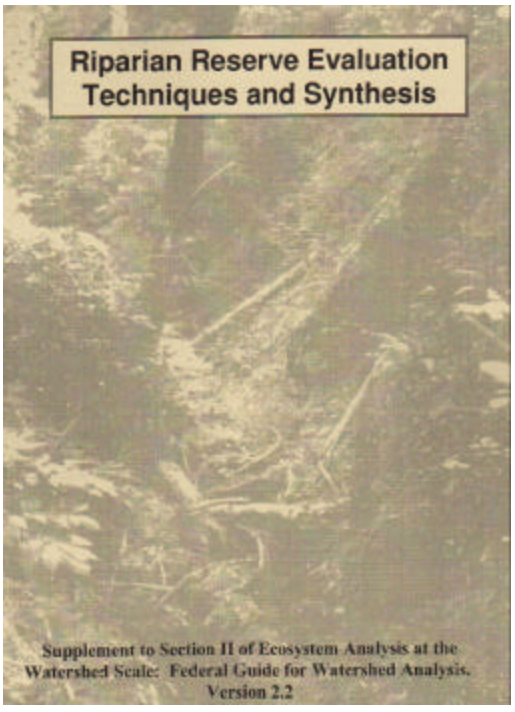
52 pages, illustrated



Riparian Reserve Evaluation Techniques and Synthesis in Ecosystem Analysis at the Watershed Scale - Federal Guide for Watershed Analysis, Section II. Multi-agency, 1995. Version 2.2. Regional Ecosystem Office, P.O. Box 3623, Portland, OR 97208

Summary: *This supplement is part of the federal guide developed to help resource managers implement direction in the Record of Decision (ROD) for Amendments to Forest Service and Bureau of Land Management Planning Documents within the range of the Northern Spotted Owl. The ROD requires watershed analysis prior to the final delineation and management of the Riparian Reserve network in a watershed. The riparian analysis process is divided into two levels based on anticipated activities: Level 1 - geared toward small effects along intermittent streams, and Level 2 - addresses larger magnitude effects.*

42 pages, illustrated



SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Role of GIS in Selecting Sites for Riparian Restoration Based on Hydrology and Land Use. Utah State University, 1997. G. Russell, C. Hawkins, M. O'Neill. Watershed Science Unit, Logan, UT 84322-5250

Summary: *The paper describes an approach to initial site selection in the San Luis Rey River watershed in southern California that uses watershed-level information on basin topography and land cover to rank the potential suitability of all sites within a watershed for either preservation or restoration. The approach requires the use of a geographic information system (GIS) to map relative wetness and land cover within a watershed. Relative potential wetness values were derived from USGS 30-m digital elevation models; land cover was derived from a Landsat scene covering the 1500 km^2 study area. The paper is illustrated with color diagrams and pictures.*

13 pages, illustrated

The Role of GIS in Selecting Sites for Riparian Restoration Based on Hydrology and Land Use

Gordon D. Russell[1,3]
Charles P. Hawkins[2,3]
Michael P. O'Neill[3]

Abstract

Successful long-term wetland restoration efforts require consideration of hydrology and surrounding land use during the site selection process. This article describes an approach to initial site selection in the San Luis Rey River watershed in southern California that uses watershed-level information on basin topography and land cover to rank the potential suitability of all sites within a watershed for either preservation or restoration. This approach requires the use of a geographic information system (GIS) to map relative wetness and land cover within a watershed. Relative potential wetness values were derived from U.S. Geological Survey (USGS) 30-m digital elevation models by calculating the flow that would potentially accumulate at all 30-m × 30-m pixels within the watershed. Land cover was derived from a Landsat scene covering the 1500 km^2 study area. We ranked sites homogenous groups of pixels ~ 1 ha with similar land cover in terms of their potential for restoration or preservation based on their wetness values (low, medium, and high), size, and proximity to existing riparian vegetation. Sites with medium or high wetness values and extant vegetation were identified as potential preservation sites. Agricultural or barren sites with medium to high wetness were identified as potential restoration sites. Approximately 5500 ha (3.67% of the total watershed) were prioritized for preservation or restoration.

Introduction

The overall purpose of this study was to develop an approach to selecting and prioritizing sites for riparian wetland restoration. The need for such a methodology stems primarily from the growth of wetland restoration and creation driven by mitigation for unavoidable losses due to development. Examination of existing restoration projects reveals that there is much room for improvement in how wetland mitigation projects are designed, developed, and implemented (Kentula et al. 1992). A coherent, consistent methodology for site selection that considers the physical and biological ability of sites to support wetland function may contribute to greater success in restoration efforts. Any such methodology should be simple, flexible, and repeatable, and should have general applicability.

Defining and delineating wetlands is almost always inherently problematic. Smith (1990) said that wetlands are a "halfway world between terrestrial and aquatic ecosystems and exhibit some characteristics of each." They often form a continuous gradient between uplands and open water. In general, wetlands are areas where saturation or inundation with water is the primary factor determining the nature of soil development and the types of biotic communities existing therein (Wilen & Frayer 1990).

There are several distinctly different classes of wetlands. This study focuses only on riparian, or "river-influenced" wetland environments, and does not address other major wetland habitats, such as marine, estuarine, or lacustrine, as described by Cowardin et al. (1979). Within this classification system, riparian wetlands can be categorized as palustrine (freshwater) environments.

The success of riparian wetland mitigation efforts depends on many factors. Foremost, objectives of the effort must be clearly defined (Zentner & Platts 1990). Once the goals have been identified, the issue of site selection can be addressed. Selection of sites with the highest potential for successful restoration/creation is a logical component of the effort to obtain restoration goals. The term "mitigation" is used herein to include the restoration and creation of riparian wetland habitats.

RWRP Lotic Health Assessment. University of Montana, 1999. W. Thompson et al, Riparian and Wetland Research Program, School of Forestry. Missoula, MT 59812

Summary: *The assessment is a method for rapidly addressing a lotic site's overall health or condition. It provides a site rating useful for setting management priorities and stratifying riparian sites for remedial action or more rigorous analytical attention. It is intended to serve as a first approximation, or "coarse filter," by which to identify lotic wetlands in need of closer attention so that managers can more efficiently concentrate effort. The term "riparian health" is used to mean the ability of a riparian reach (including the riparian area and its channel) to perform certain functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary production. The current version of the assessment and an accompanying detailed lotic inventory procedure can be found at the web site http://www.rwrp.umt.edu.*

25 pages, illustrated

May 15, 1999

RWRP LOTIC HEALTH ASSESSMENT (STAND-ALONE) CARDS AND INSTRUCTIONS

These cards and instructions are intended to accompany the (RWRP) Riparian and Wetland Research Program's Lotic Health Assessment (Stand-Alone) Form for the rapid evaluation of lotic (riparian) wetlands. Another form entitled the RWRP Lotic Health Assessment (Team/Admin Form), with a different set of cards and instructions, is available for lentic (still water) wetlands.

BACKGROUND INFORMATION

Introduction

Public and private land managers are being asked to improve, or maintain long (riparian) habitats and stream water quality on lands throughout the West. Three questions that are generally asked about a wetland site are: 1) What is the potential of the site (e.g., climax or potential natural community)? 2) What plant communities currently occupy the site? and 3) What is the overall health condition of the site? For a lotic (flowing water) site, the first two questions can be answered by using the RWRP Lotic Inventory Form along with Classification and Management of Montana's Riparian and Wetland Sites (Hansen and others 2000) or a similar publication.

This RWRP Lotic Assessment (Stand-Alone) is a method for rapidly addressing the third question above: what is the site's overall health condition? It provides a site rating useful for setting management priorities and stratifying riparian sites for remedial action or more rigorous analytical attention. It is intended to serve as a first approximation, or "coarse filter" by which to identify lotic wetlands in need of closer attention so that managers can more efficiently concentrate effort. We use the term "riparian health" to mean the ability of a riparian reach (including the riparian area and its channel) to perform certain functions. These functions include sediment trapping, bank building and maintenance, water storage, aquifer recharge, flow energy dissipation, maintenance of biotic diversity, and primary production.

Flowing Water (Lotic) Wetlands vs. Still Water (Lentic) Wetlands

Cowardin and others' (1979) point out that no single, correct definition for wetlands exists, primarily due to the nearly unlimited variation in hydrology, soil, and vegetative types. Wetlands are lands transitional between aquatic (water) and terrestrial (upland) ecosystems. Windell and others (1986) state that "wetlands are part of a continuous landscape that grades from wet to dry. In many cases, it is not easy to determine precisely where they begin and where they end."

In the semi-arid and arid portions of western North America, a useful distinction has been made between wetland types based on associations with different aquatic ecosystems. Several authors have used ***lotic*** and ***lentic*** to separate wetlands associated with flowing water from those associated with still water. The following definitions represent a synthesis and refinement of terminology from Sloan and Prather (1968), Hansen and Reid (1975), Reid and others (1976), Cowardin and others (1979), American Fisheries Society (1980), Johnson and Carothers (1980), Cooperrider and others (1986), Windell and others (1986), Environmental Laboratory (1987), Kentula (1997), Federal Interagency Committee for Wetland Delineation (1989), Mitsch and Gosselink (1993), and Rose (1994).

Lotic wetlands are associated with rivers, streams, and drainageways. Both wetlands, also referred to as riparian wetlands, contain a defined channel and floodplain. The channel is an open conduit which periodically or continuously carries flowing water and dissolved and suspended material. Flower ponds, seeps, springs, and wet meadows on the floodplain of or associated with, a river or stream are part of the lotic wetland.

Lentic wetlands are associated with still water systems. These wetlands occur in basins and lack a defined channel and floodplain. Included are permanent (i.e., perennial) or intermittent bodies of water such as lakes, reservoirs, potholes, marshes, ponds, and stockponds. Other examples include fens, bogs, wet meadows, and seeps not associated with a defined channel.

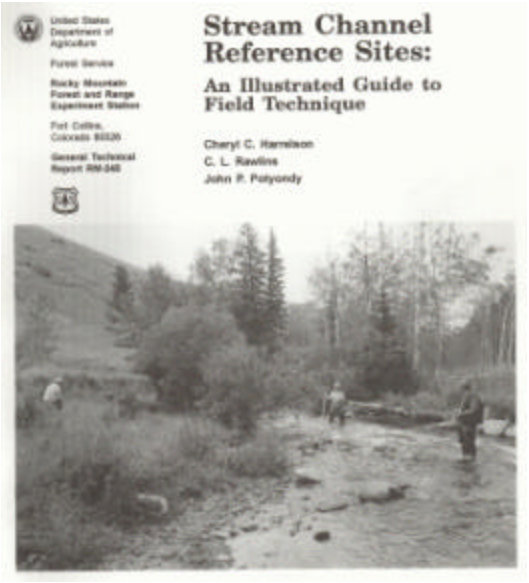
Data current as of 05/15/1999 RWRP Lotic Health Assessment 1 Check RWRP Web Site for Most Up to Date Data Set and Form

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Stream Channel Reference Sites: An Illustrated Guide to Field Technique. USDA Forest Service, 1994. General Technical Report RM-245. C. Harrelson et al. Rocky Mountain Forest and Range Experiment Station, Ft. Collins, CO

Summary: *The guide helps users establish permanent reference sites. The minimum procedure consists of: 1) select a site, 2) map the site and location, 3) measure the channel cross-section, 4) survey a longitudinal profile of the channel, 5) measure stream flow, 6) measure bed material, and 7) permanently file the information with the "Vigil" network. The document includes basic surveying techniques and provides guidelines for identifying bankfull indicators and measuring other important stream characteristics. The object is to establish the baseline of existing physical conditions for the stream channel. The guide is amply illustrated with diagrams and black-and-white pictures.*

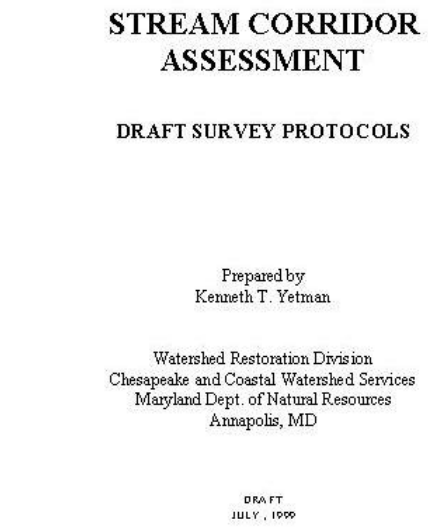
61 pages, illustrated



Stream Corridor Assessment - Draft Survey Protocols. Maryland Department of Natural Resources, 1999. K. Yetman, Watershed Restoration Division, Chesapeake and Coastal Watershed Services, Annapolis, MD 21401.

Summary: *The survey protocols help users identify environmental problems and prioritize restoration opportunities that exist within Maryland watersheds. The assessment is designed to be done by small teams of well-trained volunteers who walk two or more stream miles per day. Potential environmental problems identified during a survey include channelized stream sections, stream bank erosion, exposed pipes, inadequate stream buffers, fish blockages, trash dumping sites, near stream construction, pipe outfalls, and general conditions of in-stream and riparian habitat. In conjunction with the AmeriCorp program, over 700 miles of Maryland streams have been surveyed using the assessment protocols. This has led to more than $1 million of restoration work to date. One Maryland county has included the assessment as part of the NPDES permit system for municipal stormwater discharges.*

101 pages, illustrated


STREAM CORRIDOR
ASSESSMENT

DRAFT SURVEY PROTOCOLS

Prepared by
Kenneth T. Yetman

Watershed Restoration Division
Chesapeake and Coastal Watershed Services
Maryland Dept. of Natural Resources
Annapolis, MD

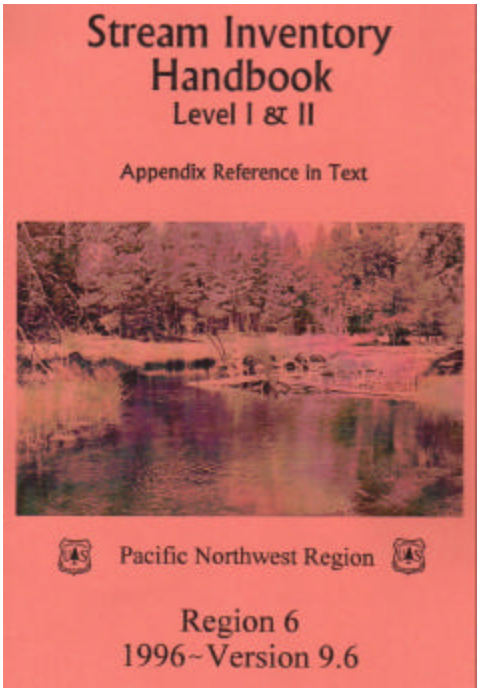
DRAFT
JULY, 1999

SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Stream Inventory Handbook - Level I and II. USDA Forest Service, 1996. Version 9.6. Region 6, P.O. Box 3623, Portland, OR 97208

Summary: *The handbook provides standards for a level I (office inventory) and level II (field inventory) of stream systems. The protocol identifies core attributes necessary to evaluate the condition of a stream. It contains instructions and data forms for stream habitat conditions (flow, water quality, historical land use, valley-channel parameters, streambed substrate, flood prone dimensions, and riparian habitat dimensions). Other data forms are included for inventorying culverts, falls, chutes, dams, marshes, braids, and fish species.*

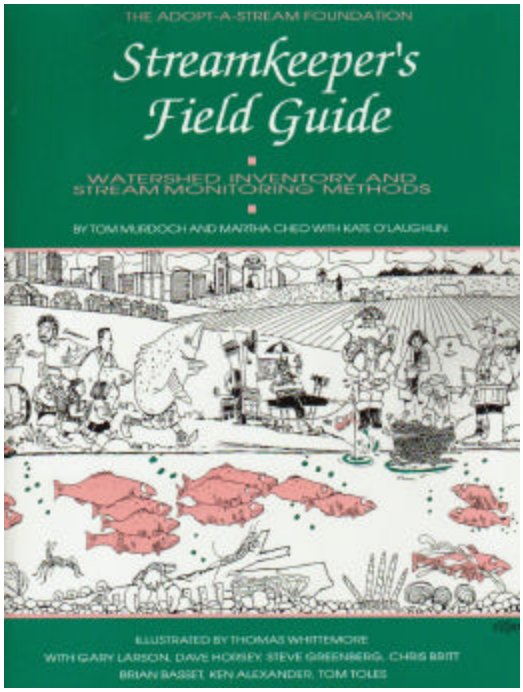
76 pages, illustrated



Streamkeeper's Field Guide - Watershed Inventory and Stream Monitoring Methods. The Adopt-A-Stream Foundation, 1996. T. Murdoch, M. Cheo and K. O'Laughlin. 600-128th Street SE, Everett, WA 98208

Summary: *The guide provides methods for obtaining a holistic picture of a stream's watershed as well as collecting detailed information. The techniques presented in the guide are fairly simple, inexpensive and can be accomplished with readily available equipment. Readers not only learn how to evaluate the physical and biological characteristics of streams using the latest quality control and quality assurance planning techniques, but can also study a chapter devoted to presenting field data to a wide range of audiences. The section called "Streamkeeper Tales" includes inspirational examples of volunteers who have used their field data as the basis for protecting and restoring streams. The active voice of the text and the large number of humorous technical illustrations which are accompanied by poignant editorial cartoons make this book engaging to volunteers and scientists alike.*

296 pages, illustrated

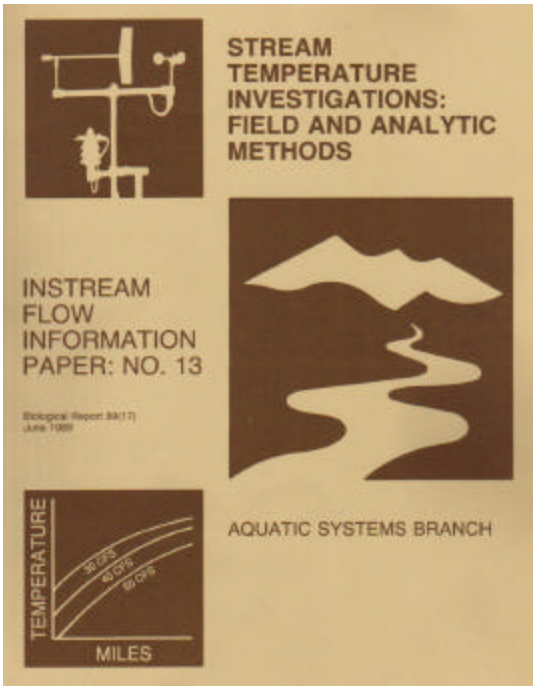


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Stream Temperature Investigations: Field and Analytic Methods (for use with SNTEMP: Stream Network Temperature Model). U.S. Fish and Wildlife Service, 1989. Instream Flow Information Paper No. 13. Biological Report 89(17). J. Bartholow, National Ecology Research Center, 2627 Redwing Road, Ft. Collins, CO 80526-2899

Summary: *The document provides guidance to the user of the Stream Network Temperature Model (SNTEMP). Planning, executing, and using the results from a stream temperature modeling study are discussed. Details of field data gathering, instrumentation, and data collection priorities are given for the range of stream geometry, meteorology, and hydrology components necessary for the model's application. Each input variable is defined, and its relative data collection effort is approached from the perspective of sensitivity in predicting stream temperatures. Alternative public domain stream and reservoir temperature models and techniques are also described.*

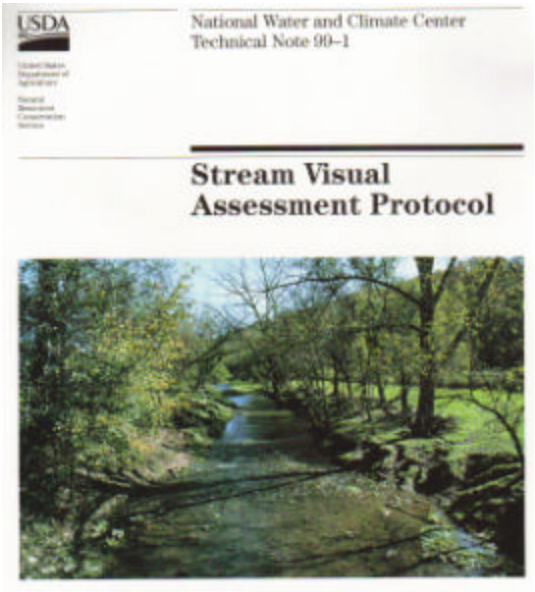
139 pages, illustrated



Stream Visual Assessment Protocol. USDA Natural Resources Conservation Service, 1998. B. Newton et al., 101 SW Main St., Suite 1600, Portland, OR 97204-3225

Summary: The assessment protocol provides a basic level of stream health evaluation based primarily on physical conditions for a stream reach. It is intended to be conducted with the landowner and incorporates talking points for planners to use during an assessment. Assessment elements, which receive a numerical rating based on observations and some rapid measurements, include: channel condition, hydrologic alteration, riparian zone, bank stability, water appearance, nutrient enrichment, barriers to fish movement, instream fish cover, pools, invertebrate habitat, canopy cover, manure presence, salinity, riffle embeddedness and macroinvertebrates observed. Rating criteria and worksheets are included. The protocol works best if locally modified.

36 pages, illustrated

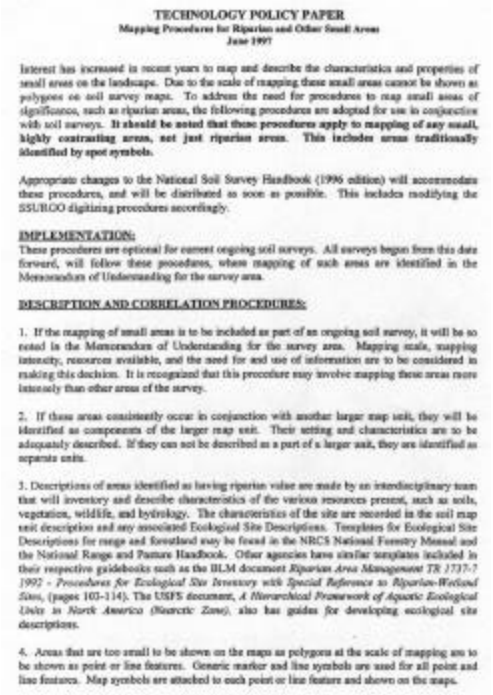


SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Technology Policy Paper - Mapping Procedures for Riparian and Other Small Areas. USDA Natural Resources Conservation Service. 1997. Soil Survey Division, P.O. Box 2890, Washington, DC 20013

Summary: *The paper outlines the procedure for mapping riparian and other small areas which were traditionally identified by spot symbols on soil survey maps. Riparian areas are typically very linear and are more difficult to map and display than upland soil polygons. Certain soils, hydrology and vegetation criteria must be met for an area to be identified and mapped as a riparian area. Cartographic procedures for delineating "point" and "line" features are included. Examples of soil map unit descriptions and a sample soils map are provided.*

12 pages, illustrated



TECHNOLOGY POLICY PAPER
Mapping Procedures for Riparian and Other Small Areas
June 1997

Interest has increased in recent years to map and describe the characteristics and properties of small areas on the landscape. Due to the scale of mapping these small areas cannot be shown as polygons on soil survey maps. To address the need for procedures to map small areas of significance, such as riparian areas, the following procedures are adopted for use in conjunction with soil surveys. **It should be noted that these procedures apply to mapping of any small, highly contrasting areas, not just riparian areas. This includes areas traditionally identified by spot symbols.**

Appropriate changes to the National Soil Survey Handbook (1996 edition) will accommodate these procedures, and will be distributed as soon as possible. This includes modifying the SSURGO digitizing procedures accordingly.

IMPLEMENTATION:
These procedures are optional for current ongoing soil surveys. All surveys begun from this date forward, will follow these procedures, where mapping of such areas are identified in the Memorandum of Understanding for the survey area.

DESCRIPTION AND CORRELATION PROCEDURES:

1. If the mapping of small areas is to be included as part of an ongoing soil survey, it will be so noted in the Memorandum of Understanding for the survey area. Mapping scale, mapping intensity, resources available, and the need for and use of information are to be considered in making this decision. It is recognized that this procedure may involve mapping these areas more intensely than other areas of the survey.

2. If these areas consistently occur in conjunction with another larger map unit, they will be identified as components of the larger map unit. Their setting and characteristics are to be adequately described. If they can not be described as a part of a larger unit, they are identified as separate units.

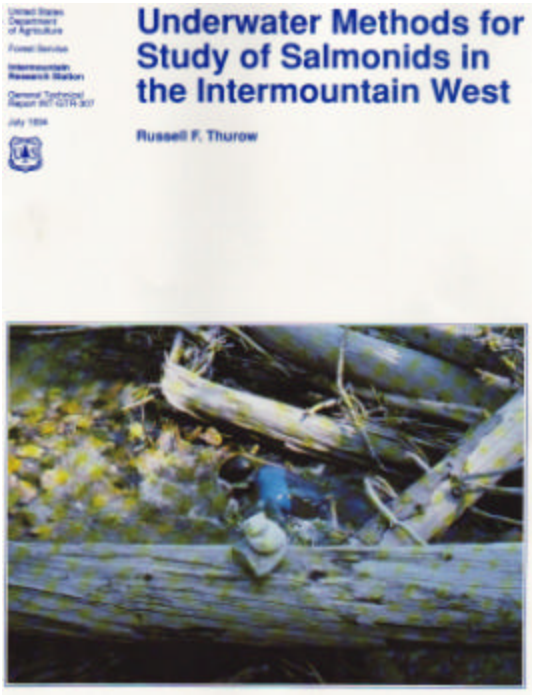
3. Descriptions of areas identified as having riparian value are made by an interdisciplinary team that will inventory and describe characteristics of the various resources present, such as soils, vegetation, wildlife, and hydrology. The characteristics of the site are recorded in the soil map unit description and any associated Ecological Site Descriptions. Templates for Ecological Site Descriptions for range and forestland may be found in the NRCS National Forestry Manual and the National Range and Pasture Handbook. Other agencies have similar templates included in their respective guidebooks such as the BLM document *Riparian Area Management TR 1737-7 1992 - Procedures for Ecological Site Inventory with Special Reference to Riparian-Wetland Sites*, (pages 103-114). The USFS document, *A Hierarchical Framework of Aquatic Ecological Units in North America (Nearctic Zone)*, also has guides for developing ecological site descriptions.

4. Areas that are too small to be shown on the maps as polygons at the scale of mapping are to be shown as point or line features. Generic marker and line symbols are used for all point and line features. Map symbols are attached to each point or line feature and shown on the maps.

Underwater Methods for Study of Salmonids in the Intermountain West. USDA Forest Service, Intermountain Research Station, 1994. Russell F. Thurow, General Technical Report INT-GTR-307. 324 25th Street, Ogden, UT 84401

Summary: *Underwater observation with snorkeling gear is a valuable tool for studying fish populations and assessing how fish use habitat in flowing waters. Precise estimates of fish abundance can be obtained using underwater counts. However, several factors, including the behavior of the target fish species and attributes of the physical habitat (stream size, water clarity, temperature, cover), can bias results. This report was developed to assist biologists in identifying and accounting for potential biases and to encourage a standardized procedure for the use of underwater techniques to survey salmonids in streams. The guide addresses the principal resident and anadromous salmonids found in the Intermountain West (Idaho, Montana, Nevada, Utah, and western Wyoming). Color illustrations and pen-and-ink drawings of target fish are included.*

28 pages, illustrated



SUMMARIES - Individual Techniques (and cover pages) - alphabetical order

Water Quality Indicators Guide - Surface Water (Chapter 2 and Appendices A and F). Terrene Institute, 1996. Second Ed. 1717 K St., Suite 801, Washington, DC 20006-1504

Summary: *The guide examines 5 major sources of agriculturally related nonpoint source pollution -- sediment, nutrients, animal waste, pesticides and salts. Field sheets are provided to enable the user to observe and record surface water quality problems and to select appropriate remedial practices. Field sheets are arranged in matrix format with environmental indicators given for each of the 5 major pollutant types. Each indicator is divided into descriptions of the environment from excellent to poor with each description given a weighted numerical ranking. There are 2 types of field sheets: 1) one for receiving waters, and 2) one for the lands that drain into receiving waters.*

131 pages, illustrated